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YALE UNIVERSITY

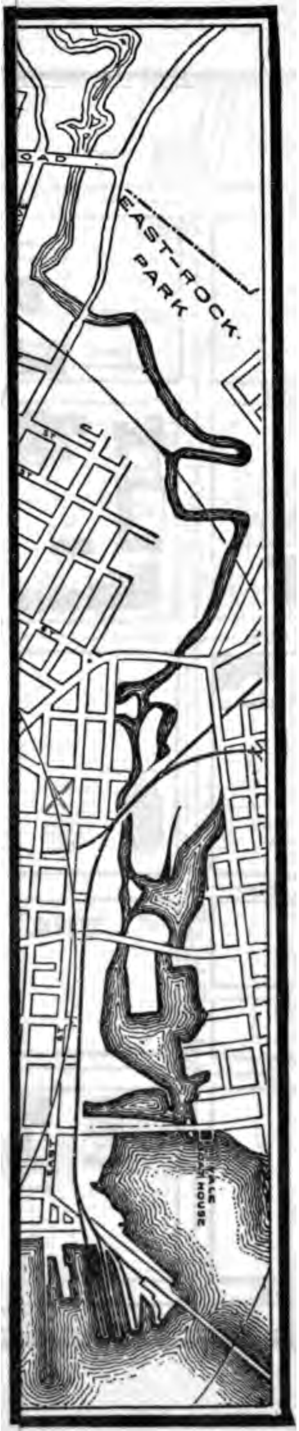
Department of Forestry

UNIV. OF MICH
OCT 10 1908

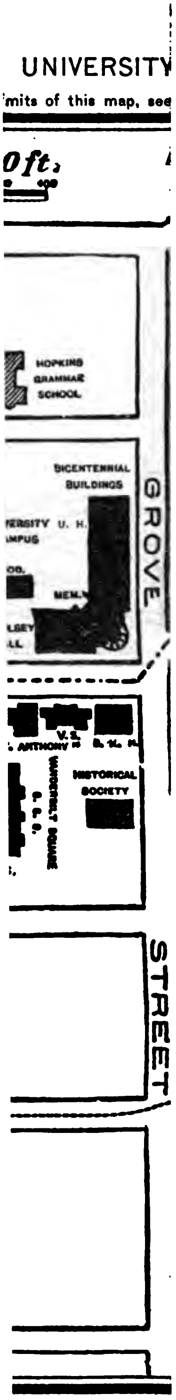
(YALE FOREST SCHOOL)

1908–09

New Haven
The Tuttle, Morehouse & Taylor Company
1908

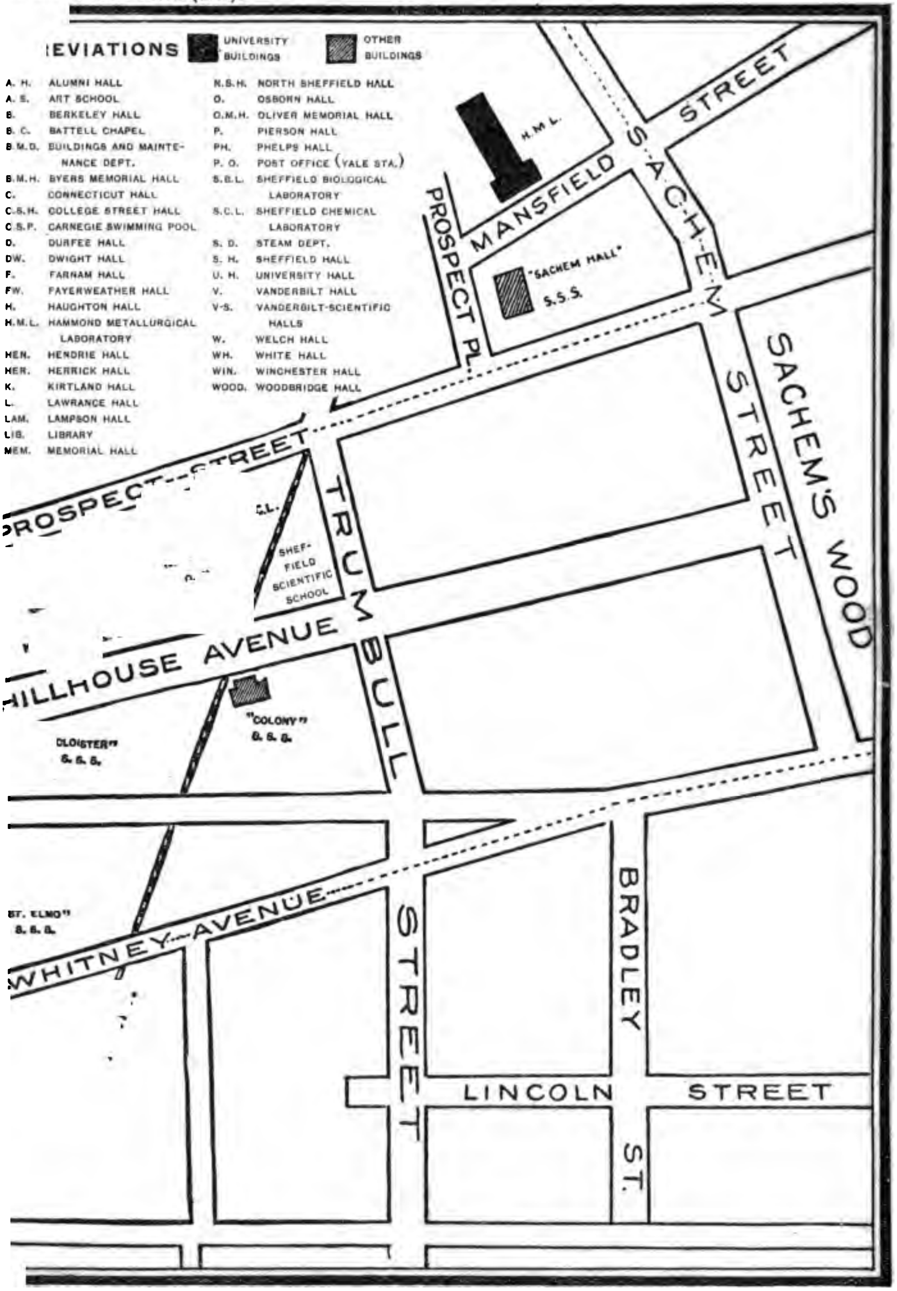


MAP OF THE CITY OF NEW HAVEN.



BUILDINGS.

the map of New Haven (over).



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B.	BERKELEY HALL	O.M.H.	OLIVER MEMORIAL HALL
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YALE UNIVERSITY

Department of Forestry

(YALE FOREST SCHOOL)

1908–09

New Haven
THE TUTTLE, MOREHOUSE & TAYLOR COMPANY
1908

CALENDAR

1908		
25 Nov.	Wednesday	THANKSGIVING RECESS begins, 1.20 P. M.
27 Nov.	Friday	THANKSGIVING RECESS ends, 8.00 A. M.
16 Dec.	Wednesday	FALL TERM ends, 6.00 P. M.
1909		
6 Jan.	Wednesday	WINTER TERM begins, 8 A. M.
25 Feb.	Thursday	WINTER TERM ends (Senior class).
31 March	Wednesday	WINTER TERM ends (Junior class).
15 April	Thursday	SPRING TERM begins (Junior class).
30 June	Wednesday	COMMENCEMENT.
6 July	Tuesday	SUMMER TERM begins.
11 Sept.	Saturday	SUMMER TERM ends.
30 Sept.	Thursday	FALL TERM begins.

UNIVERSITY OF MICHIGAN

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Gifford Pinchot, Sc.D., *Professor of Forestry*
James William Toumey, M.S., *Professor of Forestry*

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Ralph Chipman Hawley, M.F., *Instructor in Forestry*
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EQUIPMENT OF THE SCHOOL

GENERAL ENDOWMENT

The Yale Forest School was founded in 1900 by the gift of one hundred and fifty thousand dollars from Mr. and Mrs. James W. Pinchot and their sons, Gifford and Amos R. E. Pinchot. The gift provides for the establishment of a Department in the University to be known as the Yale Forest School, for instruction and research in Forestry. The gift also provides for a Summer School of Forestry in Milford, Pike County, Pennsylvania.

The endowment of the School was increased in 1903 by an additional gift of fifty thousand dollars from Mr. and Mrs. James W. Pinchot, and Professor Gifford Pinchot.

In 1905 the National Lumber Manufacturers' Association voted to raise a fund among the lumbermen of the country to establish a Chair of Applied Forestry and Lumbering at the Forest School. The School has so far received sixty-five thousand dollars towards this chair.

IN NEW HAVEN

Marsh Hall, the residence of the late Professor Othniel C. Marsh, 360 Prospect St., is used as the School building. It is equipped with lecture rooms, a library and reading room, and botanical and wood-testing laboratories.

The library contains about seven thousand books and pamphlets. It includes the important works on Forestry in English, French, and German.

In the reading room about forty periodicals, including the important lumber journals and the technical forest journals published in this country and abroad, are placed at the disposal of the students.

The botanical laboratory is equipped with simple and compound microscopes, and other apparatus and material useful in botanical instruction and research. The laboratory is provided with modern facilities for photographic and photo-micrographic work.

UNIVERSITY OF MICHIGAN

An herbarium, containing six thousand mounted sheets of native and exotic trees and shrubs and the more important forest herbs, is arranged for the use of students engaged in research. A large collection of forest tree fruits and seeds is available for students of Dendrology.

The wood-testing laboratory is equipped for research and instruction in the physical, structural, and mechanical properties of wood. The equipment includes testing machines; planers, lathes, and saws for shaping material for testing; xylometers, drying ovens, chipping machines, and a dry kiln; as well as a large amount of smaller machinery and tools useful in timber testing. The present arrangement of coöperative work with the Federal Forest Service gives students of Forest Technology exceptional facilities for research in the strength and other mechanical properties of timber.

A large collection of domestic and exotic woods is available for students' use. This collection contains boards and planks of most of the important economic species. In addition, nearly all the American species are represented by small hand specimens. Among exotic species, the Central American, West Indian, and Philippine woods are particularly well represented.

Transits, levels, plane tables, compasses, barometers, calipers, height measures, chains, tapes, and other instruments, are provided for the courses in Surveying, Forest Mensuration, Silviculture, and Forest Management.

The following departments of the University are open to Forest students: The University Library, the Yale Dining Hall, the University Gymnasium, the Yale Infirmary, and the Bureau of Self-Help.

An important part of the equipment of a Forest School is a Demonstration Forest for field instruction and for demonstration of practical Forestry. The Yale Forest School is fortunate in having the use of the extensive holdings of the New Haven Water Company for this purpose. These holdings aggregate about nine thousand acres, of which over half are already wooded. The Company is practicing forestry on its lands under the direction of Mr. Hawley of the staff of the Forest School. A portion of the forest has been under management since 1900, so that there are already very instructive illustrations of silvicultural treatment.

IN MILFORD, PENNSYLVANIA

In addition to the plant in New Haven, the School is provided with a complete equipment in the field for instruction and research. This is located at Milford, Pike Co., Penn., where the work of the Summer School is conducted. Milford lies on the west bank of the Delaware river, eight miles below Port Jervis, New York, whence it is reached by stage running regularly twice a day. Port Jervis is on the direct line of the Erie railroad.

The School is located on the estate of the late Mr. James W. Pinchot, who erected a number of buildings for the class work and gave the use of his woodland for field instruction.

THE STONE COTTAGE.—This building contains a lecture hall, a botanical laboratory, and a small library and reading room.

FOREST HALL.—This is a large stone and concrete building erected by Mr. James W. Pinchot and Mr. Gifford Pinchot for the use of the Forest School. It is located in the village of Milford, Penn., and is especially designed for lectures, which are open to the public. The building contains a spacious hall, 60 by 30 feet, capable of accommodating about 200 persons.

JUNIOR HALL.—This is a frame building containing a single large lecture room for the work of the Junior class in the courses in Forest Mensuration and Surveying.

THE CLUB HOUSE.—This building is designed as a gathering place for evening study and recreation.

THE SCHOOL CAMP.—A fully equipped camp is provided for those who desire to live in tents. It is situated on high dry ground, about eight hundred feet above sea level, a location which is exceedingly healthful. The tents are erected on board floors and each is furnished with a cot, table, chairs, washstand, and crockery. The students take their meals together in a large mess hall.

TRACTS FOR FIELD WORK.—Field work is conducted chiefly on the tracts owned by the Pinchot estate and those owned by Professor Graves. These tracts aggregate over one thousand acres and are peculiarly well adapted to the purposes of instruction in Forestry.

EXPERIMENTAL WORK.—Gifts of the late Mr. James W. Pinchot have enabled the School to conduct at Milford experiments in Silviculture. The work done so far comprises the establishment of a forest nursery and of experimental plantations and the laying out of permanent sample plots for repeated observation of the results of different methods of treatment.

TERMS OF ADMISSION

The Forest School is a graduate department requiring for admission a college training. Graduates of universities, colleges, or scientific institutions of high standing are admitted upon presentation of their diplomas, provided they have had courses in Elementary Botany, General Geology, Inorganic Chemistry, Physics, Mathematics through Trigonometry, Economics, and Modern Languages.

Undergraduates who expect to enter the Forest School after graduation are advised to take also courses in Plant Physiology, Morphology of Plants, advanced Geology (including Mineralogy), Zoology, Meteorology, Physical Geography, Mechanical Drawing, Organic Chemistry, and Elementary Calculus.

Students who have not had courses in Morphology of Plants and Mechanical Drawing are required to take these subjects during the Junior year of the Forest School.

Candidates for advanced standing may take examinations in any subject, but in the case of Forest Management, Forest Mensuration, Silviculture, Lumbering, Dendrology, Forest Technology, and other technical subjects, they are required, in addition, to present evidence of a specified amount of work done in the field or laboratory. Information regarding the special requirements in each of the above mentioned courses may be obtained from the Director.

COURSE PREPARATORY TO THE STUDY OF FORESTRY

An undergraduate course preparatory to Forestry is given in the Sheffield Scientific School. This course comprises not only a liberal training in Economics, English, French, and German, but also the work in Mathematics, Engineering, Botany, Geology, Chemistry, and other subjects necessary as a foundation for the study of technical Forestry. The best procedure for students in the Scientific School is to take the full course preparatory to Forestry and then two years post-graduate work at the Forest School. It is, however, possible for students in high standing to anticipate a certain amount of technical work at the Forest School in addition to that prescribed in the regular undergraduate course, and to complete their post-graduate work in Forestry in one year. Such students are required to spend two summers at the Summer School in Milford, Penn., and to do extra work in their Senior undergraduate year. The first term at Milford is taken at the end of the Junior year and the second summer term immediately upon graduation from Sheffield. The extra work required of such students in the Senior undergraduate year comprises the fall and winter lectures in Silviculture, and the courses in State Forest Law and Forest Economics. Only students who have completed their Junior year at the Scientific School without conditions are permitted to undertake this course.

REGISTRATION

There are four terms in the Junior year and three terms in the Senior year. Juniors are required to register at Milford, Penn., in July at the opening of the summer term. Seniors register in New Haven in September, when the fall term for the Junior class also opens. In 1909 the summer term begins July 6 and continues ten weeks. The fall term in 1909 begins September 30.

FEES AND EXPENSES

The annual charge for tuition for the Junior class is one hundred and fifty dollars, including the summer term, and for the Senior class one hundred and twenty-five dollars. Juniors are required to pay the first installment of the tuition, namely thirty-five dollars, when they register in July. Bills are sent from the Treasurer's office for the other installments of the Junior tuition and for all payments of the Senior tuition.

Frequent excursions are taken to points of interest near New Haven, involving an annual expense of less than ten dollars. The last half of the Senior year is spent in the lumber woods. This necessitates traveling expenses, which vary from year to year according to the locality in which the work is conducted. Ordinarily these do not exceed sixty dollars. During the Senior spring term the students live in camp, so that living expenses are reduced to a minimum.

Required text-books cost about twenty dollars each year. Other incidentals, including surveying material, drawing instruments, field maps, etc., amount to about fifteen dollars a year.

Satisfactory board and lodgings can be obtained in New Haven at prices ranging from seven dollars per week upwards.

A charge of twenty-five dollars is made for the use and care of a tent during the regular summer term at Milford.

If two persons occupy one tent, the charge is seventeen dollars and a half for each person. Students who wish to secure the reservation of a tent must apply to the Director before June 1 and make a deposit of five dollars. Board in camp is charged at cost and varies from four dollars and seventy-five cents to five dollars per week. Students are required to make deposits on board in advance. The first installment of twenty dollars is payable at registration.

The fee for graduation is five dollars.

DEGREE

Graduates of the Forest School, who have previously received a Bachelor's degree from a collegiate institution of high standing, are granted the degree of Master of Forestry.

THESES

Students are encouraged to carry on original work and to write theses under the supervision of the professors and instructors. Special credit is given for such work, but a thesis is not required for the degree.

CURRICULUM

The regular course covers a period of two years. The work is of an advanced and technical character and is designed for college graduates who already have had a thorough collegiate training in Mathematics and Natural Science. The regular two years' course gives a training for all professional work of Forestry, including a preparation not merely for practical work in the woods, but also for the broad work of forest organization in Government and State service, for handling large tracts of forest land, for consultation work for railroads, lumbermen, water companies, and other owners, for the work of public lecturing and writing, for teaching and for scientific research. Special facilities for study are offered to men preparing for Government service in the Philippine Islands, Hawaiian Islands, or Porto Rico; and for students from foreign countries who wish to prepare themselves for the work of organization in regions where Forestry has not yet been thoroughly established.

Excursions and field work form an important part of the instruction in Forestry. In the Junior year, the whole summer term, two and one half days a week in the fall term, and three days a week in the spring term, are devoted to practical work in the field. The Senior class devotes between four and five months of the college year to field work.

The last half of the Senior year is spent in the lumber woods, where the students are trained in the management of logging operations and milling, and are given their final training and practice in topographic surveying, preparation of forest maps, working plans on a large scale, estimating of timber, valuation of land, laying out roads and trails, running lines, projecting plans for lumber operations, etc. In 1906 the work was carried on at Waterville, N. H., on the lands of the International Paper Company. The spring term of 1907 was spent in southern Missouri on the lands owned by the Missouri Lumber & Mining Company. The class of 1908 had its final field instruction in central Alabama on the lands of the Kaul Lumber Company.

OPPORTUNITIES FOR ADVANCED WORK

The profession of Forestry has already become so far advanced that there are opportunities for men to specialize in certain branches of the subject. For instance, there is a call for specialists in research work in Silviculture, in Forest Products, Dendrology, and Lumbering.

Special opportunities are offered at Yale for advanced work in Forestry by graduates of forest schools who have already covered the elementary technical subjects and who wish to carry on work along some special line. A number of optional courses are offered, covering advanced work in Silviculture, Forest Management, Lumbering, and Forest Products.

The School offers abundant facilities for research work in all branches of Scientific Forestry. The botanical and wood-testing laboratories and the engineering equipment are placed at the disposal of students desiring to do original work. There are excellent opportunities both at New Haven and at Milford for carrying on research work in Silviculture in the field,, and for studying the results of Forestry in this country and abroad from the books and records in the library.

COURSES OF INSTRUCTION

JUNIOR YEAR

Summer Term: Surveying A; Forest Mensuration; Forest Botany A; Silviculture A.

Fall Term: Silviculture A; Forest Botany A and B; Forest Physiography A; Surveying B; Mechanical Drawing.

Winter Term: Silviculture B; Forest Botany A and C; State Forest Law; Forest Physiography A and B; Surveying B; Mechanical Drawing; Forest Economics; Forest Entomology.

Spring Term: Silviculture C and D'; Forest Botany A; Plant Physiology; Morphology of Plants; Forest Physiography A and C.

SENIOR YEAR

Fall Term: Forest Technology; Forest Management; Practice of Forestry in the United States; National Forests A; Federal Forest Law; Elementary Business Law; Lumbering A and C.

Winter Term: Forest Management; National Forests B; Lumbering B; Road Construction; Forestry Abroad; Preservation of Timber; Mechanical Properties of Wood.

Spring Term: Forest Surveying and Working Plans; Lumbering D. This term is spent in the lumber woods of the South.

DESCRIPTION OF THE COURSES

1 *General Morphology of Plants* (required of students who have not had the subject as undergraduates).

6 hrs. in two laboratory periods, spring term.

Professor Evans, Dr. A. H. Graves, and Mr. Nichols:—

Laboratory work and informal lectures. Beginning with the simplest forms, the various groups of plants are taken up in suitable types, and their structure, development, and mode of life studied and compared.

2 *Plant Physiology.* 6 hrs. in two laboratory periods, spring term.

Dr. A. L. Dean :—

Chemical composition of plants and soils; formative and metabolic changes of carbohydrates, fats, proteids, and inorganic elements of plants; absorption and transportation of water and food materials; the action of enzymes. A knowledge of the section on Physiology in the Text-Book of Botany by Strasburger, Noll, Schenck, and Schimper will be required.

3 *Forest Botany.*

A. *Dendrology.* 1½ hrs. throughout the year. field work additional.

Professor Toumey and Dr. A. H. Graves :—

A general taxonomic and biologic study is made of the forest trees of the United States, special attention being given to the species of economic importance. By means of lectures, herbaria, and lantern slides the student is taught the morphological and silvical characteristics of the trees. Special attention is given to the characters by which they are most readily recognized in the field. During the summer and winter terms a field study is made of the local woody flora.

B. *Morphology of Woody Plants.* 6 hrs. in two laboratory periods, fall term.

Dr. A. H. Graves :—

Special attention is given to the external morphology of the vegetative organs of woody plants, Internal morphology deals particularly with the origin and development of the tissue of woody plants and the arrangement and functions of the tissues. Emphasis is placed upon the structure and development of wood.

C. *Diseases of Trees.* 6 hrs. in two periods, winter term.

Dr. A. H. Graves :—

Lectures on the destructive diseases of the timber trees of the United States, their causes, nature, and remedies, with special attention to those of fungous origin; a period also devoted to wounds and correct methods of tree pruning; laboratory study of the microscopic structure of fungi and the manner in which they attack and decompose wood; field excursions in the study of fungi growing in the forests about New Haven.

4 *Forest Entomology.* 2 hrs. winter term.

Assistant Professor Coe:—

A course of lectures and practical exercises on such groups of insects as are of economic importance in the management of forests and the utilization of forests products. It is expected that the student will become familiar with the structure, habits, and life histories of the more injurious species as well as with such predatory and parasitic insects and other organisms as naturally limit their increase. This work is accompanied by a discussion of the methods by which the attacks of insects upon trees, lumber, and finished products may be most successfully controlled.

5 *Forest Physiography.*

Under this general head are included three closely related subjects,—physiography, lithology, and soils—a study of which is designed to supply a knowledge of the general physical conditions affecting plant growth. The fall term is devoted to physiography, the winter term to physiography and lithology, and the spring term to physiography and soils.

A. *Physiography.* 2 hrs., field work additional.

Professor Gregory and Mr. Bowman:—

A study of the origin, development, and classification of land forms, including those conditions which affect insolation, water supply, formation of soils, etc. An application of physiographic principles is made to the United States. Each physiographic province is made the subject of detailed study in which the student examines the topography, drainage, climate, and soils of the region. Text-books are used in this part of the course, but the instruction is chiefly by field exercises, map study, and assigned readings of physiographic literature.

B. *Lithology.* 2 hrs. winter term.

Professor Barrell:—

Laboratory exercises supplemented by field excursions and lectures dealing with the composition, structure, and classification of rocks. Particular attention is paid to the method of weathering and decomposition of the various rock types.

C. *Soils.* 2 hrs., field work additional, spring term.

Mr. Bowman:—

Laboratory and field exercises with occasional lectures on the origin, classification, and relative value of soils. A study is made of the chemical and physical properties of the various soil types, with special reference to their bearing on the habits and distribution of trees. Each student is required to prepare a soil map of an area of about six square miles, accompanied by a report describing soils, their relation to plant growth, ground water, etc. King's *Soils*, Hilgard's *Soils*, and *Reports of the United States Soil Survey* are used as texts.

6 *Forest Economics.* 2 hrs. winter term.

Professor Graves and Professor Brewer:—

Part played by forests in the life of the nation; influence of forests on climate, on conservation and distribution of water, on control of soil, on topography, on public health; relation of forests and forestry to agriculture, mining, stock raising, manufacturing, railroads, and other industries; character and extent of our natural forest resources, their present condition, the effect of their destruction; the nature of our forest problem; and the progress of forestry in the United States.

7 *Forest Hydrography.* 4 lectures, winter term.

Mr. F. H. Newell, Chief Engineer, U. S. Reclamation Service.

This course of lectures, illustrated by lantern slides, considers: Flow of streams; diurnal and seasonal variations, non-periodic fluctuations; regimen of various rivers; effects of forest and cultural conditions on available flow; underground water. Particular attention is given to irrigation economics, and to the work of the Reclamation Service in the construction and administration of irrigation systems in the arid West.

8 *Forest Technology.* 2 hrs. lectures, 6 hrs. laboratory, fall term.

Professor Toumey:—

The histology of wood leading to the identification and classification of the economic woods of the United States and the more important exotic species. Normal and abnormal characteristics which are harmful in timber, and abnormal characteristics, such as burls, bird's eye and curly grain, which give it a special economic value.

The appearance and material condition of wood based upon its physical constitution. The importance of color, gloss, grain, texture, odor, and resonance as an aid to identification and in giving value to wood. Wood in its relation to moisture, density, shrinking, warping, swelling, etc., and their effect upon the use of timber.

Dendro-chemistry or the properties of wood based upon its chemical constitution. The chemical constitution of various woods from a qualitative and quantitative standpoint. The carbohydrates of wood, cellulose and lignin, fuel value, pulping qualities, etc. The extractive materials, such as tannin and resin, and the destructive distillates, such as gas, alcohol, acids, and tar, charcoal, etc.

Factors which actually determine the use of the various economic woods in the United States. The uses to which woods are best suited as determined from their structural, physical, and mechanical properties.

9 *Preservation of Timber.* 2 hrs. winter term.

Professor TOUMEY:—

The structural, physical, and chemical properties of wood in relation to durability: the primary causes of decay: factors governing the lasting powers of various species; the relation of moisture content to durability; the seasoning of wood; the preservation of wood by the application of paints, oils, etc., to the surface, the theory of impregnation; the preservation of wood by impregnating with creosote, zinc chloride, and other wood preservatives; commercial methods for impregnating wood in Europe and America; description of preserving plants; the history of wood preservation in the United States; wood preservation in relation to the future timber supply; fire proofing.

10 *The Mechanical Properties of Wood.* 3 hrs. winter term.

Mr. TIEMANN:—

Lectures upon the strength of wood and its uses for structural and engineering purposes. Methods of testing for its resisting properties to different kinds of stress; elementary principles of Mechanics as applied to strength and stiffness tests; the effect of various influences upon mechanical properties, such as moisture, heat, preservatives; the principles of drying; dry kilns; comparative values of different species; final values.

The lectures are supplemented by work in the timber testing laboratory covering strength tests of various kinds. This work is done by the students throughout the course and includes tests on full sized structural timbers

11 *Silviculture.*

A. *Silvics.* 2 hrs. summer and fall terms, field work additional.

Professor GRAVES, Assistant Professor CHAPMAN, and Mr. HAWLEY:—

Principles underlying the life history of trees, their mode of growth, the influences affecting their life and development, their

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life together in the forest; the conception of forest types, the life history of forest types, modification of types under adverse conditions, improvement of types by good treatment; the methods of studying the silvical characteristics of trees and forests. The lectures are supplemented by extensive field work.

B. *Treatment of Woodlands.*

2 hrs. winter and spring terms, field work additional.

Professor GRAVES and Mr. HAWLEY:—

Principles of reproducing forests by skillful cuttings. Theoretical discussion of the different silvicultural systems of management. Practical silvicultural problems in this country, Application in different American forest regions of the clear cutting methods of natural reproduction, the methods of reserves, the methods of succesive cuttings, the selection method, and the coppice methods. Methods of thinnings for the improvement of the character and growth of forests. The field work consists of practice in marking thinnings and reproduction cuttings.

C. *Forest Seeding and Planting.*

2 hrs. lectures, and 8 hrs. field work, spring term.

Professor TOUMEY:—

The structure and form of tree seeds, their dissemination, the collecting, vitality, fertility, and cost of tree seeds. The storage of seeds and time required for germination. Broadcast seeding, partial seeding, the making of seed beds, and nursery work. Tree planting and the factors governing success. Nurse trees. Pure and mixed planting. The development of a planting plan. A large part of the work is conducted in the field. Every phase of the subject is illustrated by practical work sufficient to enable the students to undertake any work of forest planting which may later present itself.

D. *Advanced Silviculture.* 2 hrs. spring term, field and office work additional.

Mr. HAWLEY:—

Opportunity is afforded here for more advanced and detailed work in Silviculture than can be secured in the regular courses. Certain specific problems are assigned requiring: a. Work in the library, and b. Practical work and original investigation in the forest. The subjects assigned will deal with questions of silvicultural interest, but may be of a varied character:—such for example as studies of the silvical habits of forest trees, investigations of the growth of a species or yield of a forest type, details of reproducing stands under various silvicultural systems, and the working out of special problems of management.

E. *Research and Experiment in Silviculture.* Summer term.
Professor GRAVES:—

This course is designed for students who wish to make a specialty of research and experiment in silvics and silviculture. The course will be given at Milford, Penn., during the summer and will be conducted by field work, office work, and personal conferences. It will be offered in the summer of 1910.

12 *Surveying*

A. *Field Surveying.* 2½ days, summer term.
Assistant Professor TRACY and Mr. FARNHAM :—

The course begins with a thorough drill in the use of the instruments and in the solution of problems likely to occur in the field. During the second part of the course a topographic survey is made of a comparatively small area, the object being to develop correct habits of work and a knowledge of the different methods in common use. The transit and the level are the principal instruments used, and a high degree of accuracy is required. The third part of the course includes a more extended survey, made with less accuracy and more speed. Practically all the methods of surveying are introduced in this work, portions of the ground being covered several times by different methods, thus affording an excellent opportunity for observing the advantages and disadvantages of each method.

B. *Office Work.* 6 hrs. fall term, 3 hrs. winter term.
Assistant Professor TRACY and Mr. FARNHAM:—

The field notes of the surveys made at the summer camp in Milford are worked up preparatory to plotting, and all necessary computations are finished. The topographic maps are then plotted by several different methods. Additional problems in calculations of a practical nature are given throughout the course.

13 *Mechanical Drawing* (required of students who have not had the subject as undergraduates).
3 hrs. fall term.
Mr. NORTH:—

The first part of the course is preparatory to the work in mapping. It begins with a drill in the use of the drawing instru-

UNIVERSITY OF MICHIGAN

ments, and includes instruction in lettering and in the use of conventional signs for topographic maps. The remainder of the course is devoted to making simple working drawings in orthographic projection.

14 *Forest Mensuration.* 2 days per week, summer term. Assistant Professor CHAPMAN:—

Methods of determining the contents of logs and other parts of felled trees, the use of American log rules, practical log scaling, the use of the standard, cord, and cubic foot in measuring wood and timber; methods of obtaining the contents of standing trees; the use of height measures and dendrometers; the construction and use of volume tables of standing trees; methods of determining the contents of whole stands, the use of the valuation survey; practical timber cruising; study of the contents of stands for scientific work; determination of the age of trees and of stands; methods of studying the growth of trees, tree analyses, preparation of tables for the average growth of trees in diameter, in height, and in volume; extensive investigations in tree growth, determination of the growth of whole stands, and the construction of yield tables. The use of graphical methods in research work are considered in full in preparing volume tables and tables of growth.

15 *Forest Management.* 4 hrs. fall and winter terms. Assistant Professor CHAPMAN:—

The relation of Forest Management to other branches of Forestry. The policy of National, State, corporate, and private owners. Economic and business principles underlying management of forest property. A review and completion of the study of Forest Mensuration, including methods of determining the volume of trees; construction of volume tables; the estimation of standing timber; methods of studying growth of single trees, and of entire stands; prediction of growth per acre; yield tables; differences in methods of studying volume and growth under different conditions.

Forest Valuation, including the principles of compound interest and discounting; determination of costs of forest production, and of profits; present value of future profits; value of forest land; valuation of damages to forest property; value of immature timber.

Forest Regulation; the objects and principles of regulation of forest output to secure sustained yield; and the results of European experience with different methods of regulation.

Forest Working Plans; necessary data, maps, forest description, preliminary examination of tracts, compartment descriptions, and estimates, and plans for attaining the object of the owner, systematic silvicultural management, conservative lumbering, and the protection of the forest from fire and other dangers.

Forest Administration; the proper organization of the administrative force for the management of forest properties, National, State, and private.

16 *Forest Surveying and Working Plans.* Field work, spring term.

Assistant Professor CHAPMAN:—

Topographic mapping of large areas on a small scale by contours, for use in lumbering; location of old Government survey lines, corners, and witnesses; ocular methods of timber estimating on a commercial scale, accompanied by sketch maps of topography and types of timber, and complete forest descriptions, including condition of mature timber and damage, reproduction and young timber; the location and projections of logging railroads, forest roads, trails, and fire lines; silvicultural needs of the principal species; principles of a practical working plan to secure a second crop of timber, and protection from fire; study of growth, and prediction of future yield under management.

17 *Lumbering.*

Mr. BRYANT:—

Four courses in Lumbering are offered. Three of them are conducted in New Haven by lectures and recitations and are designed to give the student an understanding of the chief features of the lumber business and the principles underlying its successful conduct. The fourth course is given in the field during the four months of the spring term of the Senior year, and is conducted in the logging woods and at the mill.

A. *The Lumber Industry.* 3 hrs. fall term.

The object of this course is to acquaint students with the chief features of the lumber industry. The subjects covered include a discussion of the methods used in transporting logs from the stump to the mill; the equipment and arrangement of the manufacturing plant; the manufacture, seasoning, and grading of rough and finished lumber; domestic and foreign markets; lumber tariff; sale of lumber and market prices; organization of lumber manufacturers' associations and their relation to the

UNIVERSITY OF MICHIGAN

industry; timber bonds; insurance; the determination of stumpage values and their relation to market prices; statistics of the lumber industry. The methods of logging in vogue in the northeastern United States, Lake States, Southern Hardwoods, Yellow Pine, Cypress, Pacific Coast, and the woodlot section of New England, are discussed critically. Special periods are devoted to the study and interpretation of the lumber market quotations and to the consideration of the important news in lumber trade journals.

B. *Advanced Lumbering.* 2 hrs. fall term.

A course designed for students who desire to make a detailed study of logging and manufacturing methods and other phases of the lumber industry. An opportunity is afforded for an investigation of the methods and the cost of logging on specific operations; the utilization of steam machinery for logging; the improvement of streams; the equipment of lumber manufacturing plants; the methods of seasoning timber, etc. Only those students who have had the previous course or its equivalent are admitted to this course.

C. *Minor Industries.* 3 hrs. winter term.

A series of lectures dealing with the harvesting of tanbarks, the orcharding of turpentine, and the utilization of timber and lumber in the manufacture of shingles, lath, veneers, vehicle stock, box shooks, cooperage, spool stock, matches, excelsior, wood novelties, charcoal, etc.

D. *Field Work in Lumbering.* Spring term.

This course is conducted on some lumber operation in the southern part of the United States. The instruction includes a detailed study of the method of lumbering used by the company on whose tract the school camp is located. During the period allotted to this work the students investigate the method of logging employed, the arrangement and equipment of the manufacturing plant, the manufacture and care of rough and finished lumber, the system of grading authorized by the Yellow Pine Manufacturers' Association, etc. Various wood-working plants are frequently available for study: also operations where methods of turpentine orcharding may be investigated.

18 *Roads and Trails.* 2 hrs. winter term.

Assistant Professor CHAPMAN:—

Elementary principles governing the location and construction of roads and trails for purposes of transporting supplies, and for travel.

19 *Practical Construction Work* (optional). Summer term.

This will be a practical course in such work of construction engineering as is required of a forester on a National Forest. It includes the construction of roads, trails, bridges, dams, camps, permanent cabins, development of water supplies, etc. The work will be of a purely practical nature, and the student will do the actual work of construction wherever possible. In connection with the course such subjects will be given as the location of camps, camp hygiene, the packing of horses, the handling of horses, first aid to the injured, and other similar things of use to the man who must learn to take care of himself in the woods. The course will be given in 1910 if circumstances warrant it.

20 *The Practice of Forestry in the United States.*
3 hrs. fall term.

Mr. Hawley :—

The course deals with forest management as applied to the forests of the United States. Problems of management typical of the various forest regions are taken up and discussed at length. Practical forest management is considered in all its relations, covering: the silvicultural management of the commercially important species; data of the growth and yield of our trees and forests; the utilization of forest products; market conditions; protection; and administration. Critical discussions of the management practiced on forest tracts in the different regions will form an important part of the course.

21 *National Forests.* A. 2 hrs. fall term.

Professor Graves:—

A study of the conditions and problems of the National Forests. The Forests are considered individually and in groups with reference to: location, general topographic features, land classification, forest types, yield, industries, purpose of establishment, problems of silviculture, lumbering, protection, administration, and the work now in operation.

National Forests. B. 4 hrs., conferences additional,
winter term.

The course in National Forests deals almost entirely with the actual administration ot the National holdings of timber and range. Its aim is to give the students the point of view of the administrative officer on the ground, and a grasp of the principles and methods followed in handling all of the more important kinds of National Forest business. Four lectures are given weekly on the policy of National forest administration; the organization of the administrative force; the construction of rangers' headquarters, roads, trails, bridges, and telephone lines; the protection of National forests from fire; the sale and cutting of National timber, including a discussion of the forestry methods which have been found applicable; the administration of grazing lands and use of stock ranges within the National forests; special uses of National forest land for home building and commercial enterprises; tree planting in the National forests; the handling of claims and entries under the public land laws, and the preparation of National forest records and accounts.

A model office is conducted in connection with the lectures, and by personal work on typical cases the students are given first-hand acquaintance with administrative methods.

22 *Forest Policy.* 6 lectures, winter term.
Professor PINCHOT:—

Origins of forest policy; its objects and principles; legislation and its causes before 1891; legislation and its causes from 1891 to 1903; national organization in Forestry; the forest and other land laws in relation to economic and industrial development; State forest problems.

23 *Forest Administration.* 4 lectures, fall term.
Mr. PRICE:—

Principles of business administration as applied to a Government department; methods of conducting the business of the Government; the United States Forest Service, its historical development and its present organization; work of the Forest Service in the administration of the National forests; coöperative work with other departments of the Government, with States, and private owners; and scientific research.

24 *Forest Management Abroad.* 2 hrs. winter term.
Professor GRAVES:—

Early forest ordinances in Europe; beginnings of technical forestry; development of the technical branches; history of Government forest administration; history of forest education in Europe. The systems of Forest Administration in foreign countries; organization of the administrative departments; force of officers; duties of each; effectiveness of the service; cost; civil service regulations; relation to the army.

25 *State Forest Law.* 2 hrs. winter term.
Assistant Professor CHAPMAN:—

The fire laws of different States and the general principles of successful legislation for fire protection. The development of forest policies in the principal States, and the important laws outlining forest policy and the creation and management of State forest reserves. Forest taxation, theory, and legislation.

26 *Federal Forest Law.* 2 hrs. fall term.
Mr. BOWERS:—

The development of the public domain with reference to the creation of a forest policy by the United States and a consideration of laws relating thereto, including rules and regulations governing public lands and forest reserves, and Federal and State decisions on subjects relating to Forestry.

27 *Elementary Business Law.* 2 hrs. fall term.
Mr. BOWERS:—

This course treats of contracts, damages, real estate, riparian rights, and abstracts of title.

SPECIAL LECTURES

During the year special lectures are given on different subjects by practical experts, to supplement the regular courses outlined in the catalogue. The principal courses are as follows:

a. Work of the Branch of Forest Products, by Mr. William L. Hall, of the United States Forest Service.

b. Government Work in Timber Preservation, by Mr. William F. Sherfesee, of the United States Forest Service.

c. Methods of Collecting and Using Forest Statistics, by Mr. R. S. Kellogg, of the United States Forest Service.

d. Grazing, by Mr. A. F. Potter, of the United States Forest Service.

e. The Wholesale Lumber Trade, by Mr. Robert C. Lippincott, of Philadelphia.

f. Lumbering in the Adirondacks, by Mr. Robert W. Higbie, of New York City.

A number of other lecture courses will be given in connection with the course in Lumbering for which arrangements have not yet been completed.

LIST OF STUDENTS

IN ATTENDANCE DURING THE YEAR 1908-09

SENIOR CLASS

Fredrik Ferdinand Woods Beckman Stockholm Högre Reallaroverk 1905	*Altoona, Pa.*	717 W. D.
Frederick Howell Billard, B.A. Yale University 1896	*Meriden, Conn.*	423 Temple st.
John Manvers Briscoe	*Pottsville, Pa.*	423 Temple st.
Georges de S. Canavarro, B.S. University of Minnesota 1908	*Honolulu, H. I.*	423 Temple st.
William Darrow Clark, B.A. Yale University 1904	*Yorktown Heights, N. Y.*	74 Whalley av.
John Daniel Coffman	*New Haven, Conn.*	91 Lake pl.
Arthur Wood DuBois, B.A. Cornell University 1907	*Hallstead, Pa.*	423 Temple st.
William Edwin Dunham, PH.B. Yale University 1908	*Warren, Pa.*	57 Elm st.
Herman Edgar Fegley, B.A. Franklin and Marshall College 1904	*Auburn, Pa.*	62 Lake pl.
Frederick Alan Gaylord, PH.B. Yale University 1908	*Ansonia, Conn.*	379 Temple st.
Belknap Chittenden Goldsmith, B.S. University of California 1906	*Berkeley, Cal.*	70 Whalley av.
Edgar Clarkson Hirst, B.A. Ohio State University 1907	*Yellow Springs, O.*	60 Whalley av.
Allen Harrison Hodgson	*Chico, Cal.*	74 Whalley av.
Henry Julian Correll Humphrey, PH.B. Yale University 1908	*Brooklyn, N. Y.*	57 Elm st.
Oswald Drew Ingall, B.A. Cornell University 1907	*Montclair, N. J.*	74 Whalley av.
Henry Langley Johnson, B.A. Cornell University 1907	*Boston, Mass.*	129 Mansfield st.
Richard Chapin Jones, B.A. Vanderbilt University 1904	*Nashville, Tenn.*	60 Whalley av.
Joseph Casimir Kircher, B.A. Yale University 1907	*Belleville, Ill.*	1076 Chapel st.
Aldo Leopold, PH.B. Yale University 1908	*Burlington, Ia.*	379 Temple st.
Everett Herman MacDaniels, B.A. Oberlin College 1906	*Oberlin, O.*	74 Whalley av.
Rufus Sherrell Maddox, B.A. Yale University 1907	*Coldwater, Tenn.*	664 W. D.
Frederick Franklin Moon, B.A. Amherst College 1901	*Nazareth, Pa.*	664 W. D.
Royal Freeman Nash, B.A. Columbia University 1908	*Grand Rapids, Wisc.*	8 Prospect pl.

William Bushnell Osborne, Jr., B.A. Williams College 1907	*Victor, N. Y.*	379 Temple st.
Percy Jerauld Paxton, B.A. Williams College 1906	*Princeton, Ind.*	379 Temple st.
Reuben Parker Prichard, B.S. Dartmouth College 1907	*Somerville, Mass.*	74 Whalley av.
Abbott Beecher Silva	*Chattanooga, Tenn.*	134 Dwight st.
Robert Simmons, B.A. College of the City of New York 1905	*New York City*	32 Trumbull st.
Thomas Elliot Snyder, B.A. Columbia University 1907	*New York City*	8 Prospect pl.
Willard Springer, Jr., C.E. Lafayette College 1907	*Wilmington, Del.*	60 Whalley av.
Ernest Cousins Wheeler, B.A. Yale University 1907	*Norwalk, Conn.*	1076 Chapel st.
Chester Harvey Wilcox, C.E. Lehigh University 1907	*Center Moriches, N. Y.*	60 Whalley av.
Addison Wetherald Williamson, PH.B. Wesleyan University 1907	*Waterport, N. Y.*	91 Lake pl.
Meyer Henry Wolff, PH.B, Yale University 1908	*Brooklyn, N. Y.*	29 Sylvan av.

SENIOR CLASS, 34

JUNIOR CLASS

Walter George Alpaugh, B.S. Tufts College 1908	*Willimantic, Conn.*	13 Lake pl.
William George Baxter, B.S.A. Iowa State College 1908	*Galva, Ia.*	13 Lake pl.
George Adams Bright, B.S. Dartmouth College 1908	*Washington, D. C.*	695 W. D.
Donald Bruce, B.A. Yale University 1906	*Easthampton, Mass.*	200 F.
Norman Curtis Case, B.S. Highland College 1908	*Highland, Kans.*	90 Lake pl.
Guy Cory Cleveland, B.A. Yale University 1908	*Orange, N. J.*	53 Lake pl.
Hamilton Morel Coan, B.A. Princeton University 1907	*New York City*	17 Lake pl.
George Alexander Cromie	*Asquith, Saskatchewan*	1179 Chapel st.
Edward Stiles Davey, B.A. Yale University 1908	*Jersey City, N. J.*	210 F.
Ernest Griswold Dudley, B.A. Leland Stanford Jr. University 1908	*Stanford University, Cal.*	78 Lake pl.
Robie Mason Evans, B.A. Dartmouth College 1906	*Fryeburg, Me.*	78 Lake pl.
Harold Fay, B.A. Tufts College 1904	*Somerville, Mass.*	8 Prospect pl.

UNIVERSITY OF MICHIGAN

Max Henry Foerster Marburg Gymnasium	*Sea Cliff, L. I., N. Y.*	8 Prospect pl.
Harold Parker Gilkey, B.A. Harvard University 1908	*Richland, Mich.*	701 W. D.
James Lippincott Goodwin, B.A. Yale University 1905	*New York City*	379 Temple st.
James Ovington Hazard, PH.B. Brown University 1908	*Westerly, R. I.*	90 Lake pl.
Frank Heintzleman, B.F. Penn. State Forest Acad. 1907	*Fayetteville, Pa.*	8 Prospect pl.
Ben Hershey, B.A. Williams College 1906	*Sterling, Ill.*	53 Lake pl.
Lester Eugene Hitchcock, B.S. Coe College 1907	*Cedar Rapids, Ia.*	13 Lake pl.
Crosby Arthur Hoar, B.A. Dartmouth College 1908	*West Acton, Mass.*	78 Lake pl.
Thomas Hooker, B.A. Yale University 1908	*Hartford, Conn.*	78 Lake pl.
Julius Ansgar Larsen, B.A. Yale University 1908	*New Haven, Conn.*	418 B.
Raymond Eugene Marsh, B.S. Dartmouth College 1908	*Westport, N. H.*	715 W. D.
Frederick Ramsay Mason, B.S. Rutgers College 1905	*Bound Brook, N. J.*	13 Lake pl.
Willis Munro, B.A. Harvard University 1896, LL.B. 1899	*Buffalo, N. Y.*	1151 Chapel st.
Frank Browning Notestein, PH.B. University of Wooster 1908	*Wooster, O.*	716 W. D.
Mauricio Julian Oteyza	*Manila, P. I.*	8 Prospect pl.
Dana Parkinson, B.A. Dartmouth College 1908	*Waltham, Mass.*	715 W. D.
William Norwood Sparhawk, B.A. Yale University 1908	*West Swanzey, N. H.*	202 F.
Irving Gay Stetson, B.A. Harvard University 1907	*Bangor, Me.*	8 Prospect pl.
Albert Ogden Vorse, B.S. Bucknell University 1905	*Lewisburg, Pa.*	8 Prospect pl.
Robert Sinclair Wallace, B.A. Macalester College 1908	*St.Paul, Minn.*	716 W. D.
Edgar Fowler White, B.A. Dartmouth College 1908	*Danvers, Mass.*	53 Lake pl.
Alvin Goodnow Whitney	*Groton, Mass.*	78 Lake pl.
Walter Keene Wildes, B.A. Bowdoin College 1904	*Little Falls, N. J.*	701 W. D.
Sedman Walter Wynne	*Butte, Mont.*	62 Lake pl.

JUNIOR CLASS, 36